2009 FINAL REPORT

INTOXICATION DEATHS ASSOCIATED WITH DRUGS OF ABUSE OR ALCOHOL

BALTIMORE CITY

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July 2011

GOAL

To monitor intoxication deaths associated with substance use in Baltimore City.

HIGHLIGHTS

- **The number of intoxication deaths has continued to decrease in the last decade (2000-2009), although intoxication deaths associated with drugs of abuse or alcohol were at least 19% higher in 2009 than in 2008.** There were 181 deaths among residents in 2009, compared to 152 in 2008 (19% increase); and there were 229 deaths resulting from intoxications occurring in Baltimore regardless of residence, compared to 176 in 2008 (30% increase). The 2008 numbers were the lowest since 1995, and represented a remarkable one-year decrease that to date has not been fully understood. The increase in deaths from 2008 to 2009 in many ways returns drug of abuse and alcohol deaths to the previous trend line. Indeed, compared to 2007, the 2009 death count among residents was 23% lower. On average, we have seen a decrease of 10 deaths per year from 2000 through 2009.

- **Deaths associated with all substances increased in 2009 compared to 2008**. Increases were most pronounced for alcohol-associated deaths, which increased by 26% among city residents, and for cocaine-associated deaths, which increased by approximately 24% among city residents. Heroin-associated deaths decreased by 3%, and methadone-associated deaths remained the same.

METHODOLOGY

Briefly, records from the Maryland Office of the Chief Medical Examiner (OCME) were analyzed. The OCME reviews all deaths in Maryland caused by violence, suicide, or injury; sudden deaths in apparently healthy individuals; and deaths that are suspicious or unusual. The OCME determines cause of death based on information from the death scene, police records, medical records, autopsy results, and toxicological results. Intoxication deaths were deaths where the OCME-determined cause of death included the word "intoxication" and the manner of death was categorized by the OCME as accidental or undetermined. The methodology used was identical to that used in our previous reports (http://baltimorehealth.org/info/2008_01_24.IntoxicationDeaths.pdf).

Based on recommendations from the OCME, we classified an intoxication death as being associated with a given *drug of abuse* if either of two criteria were met: (1) the drug was mentioned in the OCME-determined cause of death, or (2) the OCME-determined cause of death used non-specific terms such as "drug intoxication" or "narcotic intoxication" and the toxicological analysis indicated the presence of the drug. Drugs of abuse considered in this analysis include opioids (eg. heroin, methadone, fentanyl), cocaine, benzodiazepines, and amphetamines among others. For a complete list, please refer to the 2008 report.

Alcohol-associated intoxication deaths were defined as deaths where "alcohol" or "ethanol" was mentioned in the OCME-determined cause of death, regardless of what was in the toxicological results. Substance-specific categories were not mutually exclusive: a death identified as associated with a given substance could have been associated with other substances as well.

Data presented here were obtained from the OCME on August 31st, 2010. We present data for deaths that occurred for the entire 2009 year and compare trends across years. As in our previous report, data is presented both for deaths among Baltimore City residents and for deaths resulting from intoxications that occurred in Baltimore regardless of residence. Further details about the methodology can be found at http://baltimorehealth.org/info/2008_01_24.IntoxicationDeaths.pdf.

RESULTS

❖ *Deaths Associated with Drugs of Abuse or Alcohol*

Overall, between January 1st 2009 and December 31st 2009, the OCME recorded 181 drug of abuse- or alcohol-associated deaths among city residents and 229 deaths resulting from drug of abuse- or alcohol-associated intoxications occurring in Baltimore City regardless of residence. This represents a 29-death (19%) increase in resident deaths compared to 2008, and a 53-death (30%) increase in deaths resulting from Baltimore intoxications (*Figure 1*). In the context of the last decade, we have seen a consistent decline in the number of intoxication deaths among Baltimore City Residents, from 281 deaths in 2000 to 181 deaths in 2009—an average decline of 10 deaths per year (*Figure 1b*). Similar declines have also been observed among deaths occurring in Baltimore City.

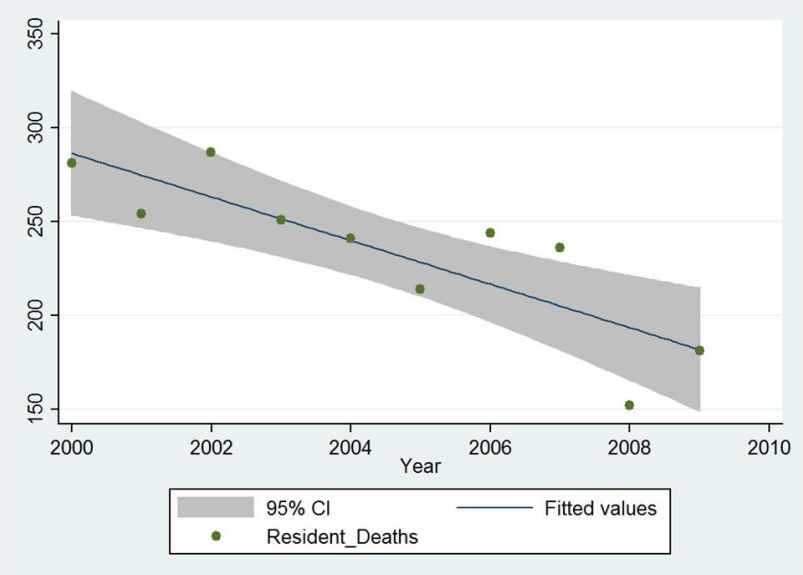
Figure 1

Intoxication Deaths Associated with Drugs of Abuse or Alcohol: Baltimore City Residents (BCR), and Deaths Occuring in Baltimore City Regardless of Residence (BCI)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
BCR	281	254	287	251	241	214	244	236	152	181
BCI	327	298	343	296	273	249	290	281	176	229

Figure 1b

Intoxication Deaths Associated with Drugs of Abuse or Alcohol: Baltimore City Residents, 2000-2009 Trend Line w/ 95% Confidence Intervals



❖ ***Substances Associated with Drug of Abuse- and Alcohol-associated Intoxication Deaths***

As in previous years, nearly all of the intoxication deaths during 2009 involved at least one drug of abuse, at 98%; alcohol without other drugs of abuse accounted for the remaining 2%. Heroin was the most common drug of abuse associated with these deaths, accounting for 48% of resident deaths and 52% of deaths resulting from intoxications occurring in Baltimore regardless of residence (*Table 1*). Deaths associated with multiple substances remained prevalent.

Deaths associated with all common substances of abuse increased in 2009 compared to 2008 (*Table 1* and *Figures 2* and *3*). Among the most common substances of abuse (heroin, cocaine, methadone and alcohol), alcohol-associated deaths increased the most among city residents, by 26% (44 deaths vs. 35 deaths). Cocaine-associated deaths saw the second largest increase among city residents at 24% (57 deaths vs. 46 deaths). Also among city residents, heroin-associated deaths decreased by 3% and methadone-associated deaths remained the same (46 total deaths in both 2008 and 2009).

Considering all 2009 deaths regardless of residence, alcohol-associated deaths increased the most, by 29% (54 deaths vs. 42 deaths). Cocaine-associated deaths saw the second largest at 25% (69 deaths vs. 55 deaths). Heroin-associated deaths increased by 11% and methadone-associated deaths remained the same (51 total deaths in both 2008 and 2009). Compared to 2008, the *proportion* of deaths associated with heroin in 2009 decreased by about 19% among city residents, while the *proportion* of deaths associated with methadone decreased by about 17% (even though the counts remained stable). Considering all deaths regardless of residence, these numbers were 13% and 24%, respectively. The proportions of deaths associated with other substances remained relatively unchanged between 2008 and 2009.

As in 2008, no buprenorphine-associated deaths were observed during 2009, compared to one such death in 2007. However, it is important to note that buprenorphine is not routinely tested for among overdose deaths, but rather only when it is deemed indicated by the OCME.

Table 1: Number and percentage of intoxication deaths associated with drugs of abuse or alcohol according to medical examiner records, by substance(s) involved, comparing 2008 to 2009

	Baltimore City Resident Deaths				Deaths Resulting from Intoxications in Baltimore City			
	2008		2009		2008		2009	
Intoxication death involves:[1]	#	%	#	%	#	%	#	%
Alcohol or at least one drug of abuse	152	100%	181	100%	176	100%	229	100%
At least one drug of abuse	147	97%	177	98%	171	97%	225	98%
Opioids	134	88%	158	87%	155	88%	201	88%
Opioids and cocaine	33	22%	39	22%	39	22%	47	21%
Opioids and alcohol	27	18%	37	20%	33	19%	45	20%
Opioids without other drugs of abuse or alcohol	80	53%	81	45%	89	51%	108	47%
Heroin	90	59%	87	48%	106	60%	118	52%
Heroin and cocaine	27	18%	24	13%	31	18%	29	13%
Heroin and alcohol	19	13%	24	13%	22	13%	31	14%
Heroin without other drugs of abuse or alcohol	38	25%	38	21%	45	26%	55	24%
Methadone	46	30%	46	25%	51	29%	51	22%
Methadone and heroin	9	6%	7	4%	12	7%	11	5%
Methadone and cocaine	4	3%	10	6%	7	4%	11	5%

Methadone and alcohol	7	5%	3	2%	8	5%	5	2%
Methadone without other drugs of abuse or alcohol	26	17%	24	13%	25	14%	24	10%
Buprenorphine[2]	0	0%	0	0%	0	0%	0	0%
Fentanyl	3	2%	4	2%	2	1%	4	2%
Codeine, Oxycodone or Hydrocodone	8	5%	7	4%	8	5%	10	4%
Cocaine	46	30%	57	31%	55	31%	69	30%
Cocaine and alcohol	11	7%	7	4%	12	7%	9	4%
Cocaine without other drugs of abuse or alcohol	10	7%	15	8%	12	7%	18	8%
Benzodiazepines	2	1%	8	4%	2	1%	10	4%
Alcohol	35	23%	44	24%	42	24%	54	24%
Alcohol without other drugs of abuse	5	3%	4	2%	5	3%	4	2%

[1] Except where noted, involvement of one substance does not preclude the possibility that other substances are involved as well.
[2] In contrast with the other substances in this table, samples are not routinely tested for buprenorphine, only when it is deemed indicated by the OCME.

Figures 2 and 3 present the number of deaths associated with specific substances for each year from 2000 to 2009 among resident deaths (*Figure 2*) and among deaths resulting from intoxications in Baltimore City regardless of residence (*Figure 3,* next page). These graphs show that deaths associated with all substances studied decreased in 2008 compared to the previous year, but rose again in 2009.

Figure 2

Intoxication Deaths Associated with Drugs of Abuse or Alcohol, Baltimore City Residents, 2000-2009

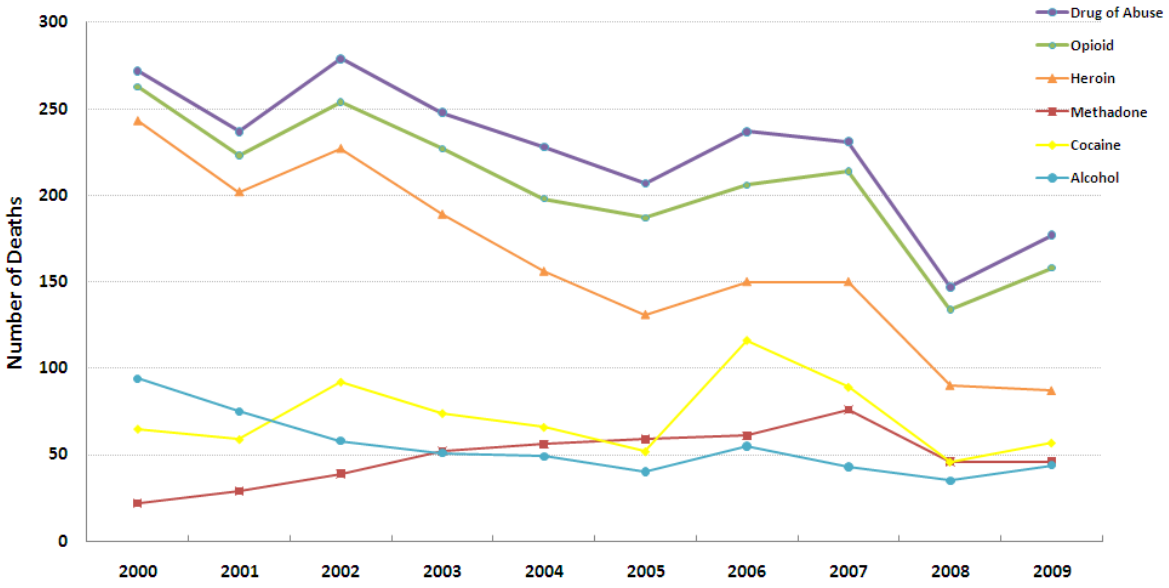


Figure 3

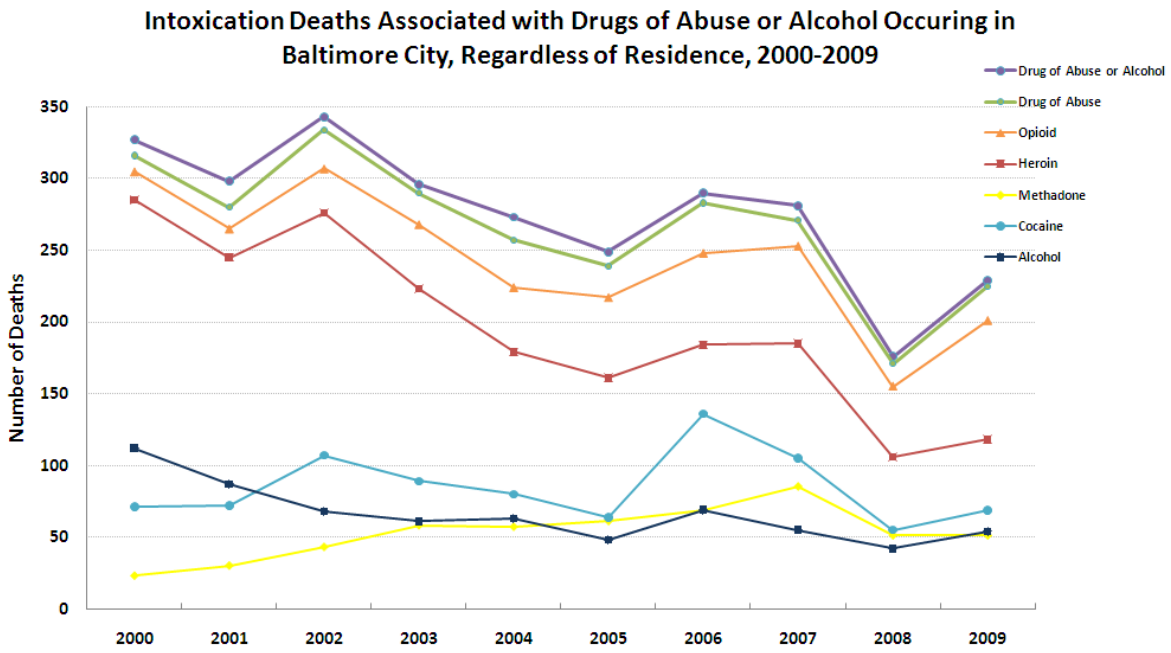


Figure 4 shows crude *rates* of death due to drug of abuse- or alcohol-associated intoxication among Baltimore city residents from 2000 to 2009. Rates present the number of deaths per 10,000 city residents. The fact that the trends in the rates are very similar to the trends in the number of deaths (*Figure 3*) means that the observed trends in the number of deaths are not substantially affected by changes in the size of the city population.

Figure 4

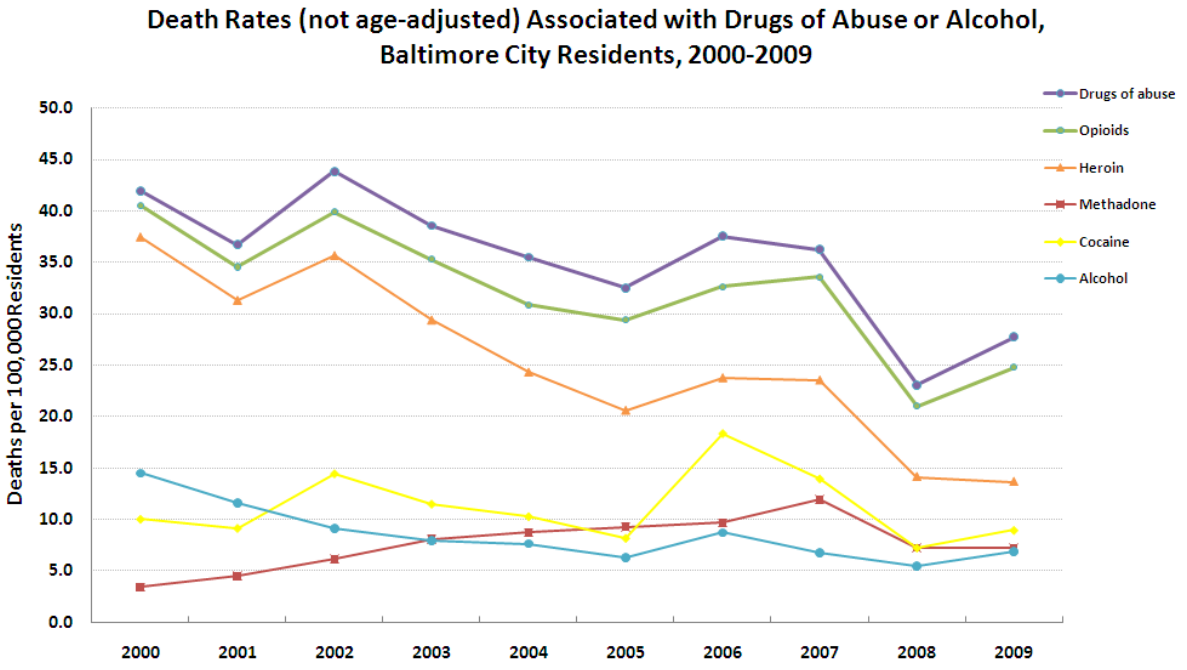
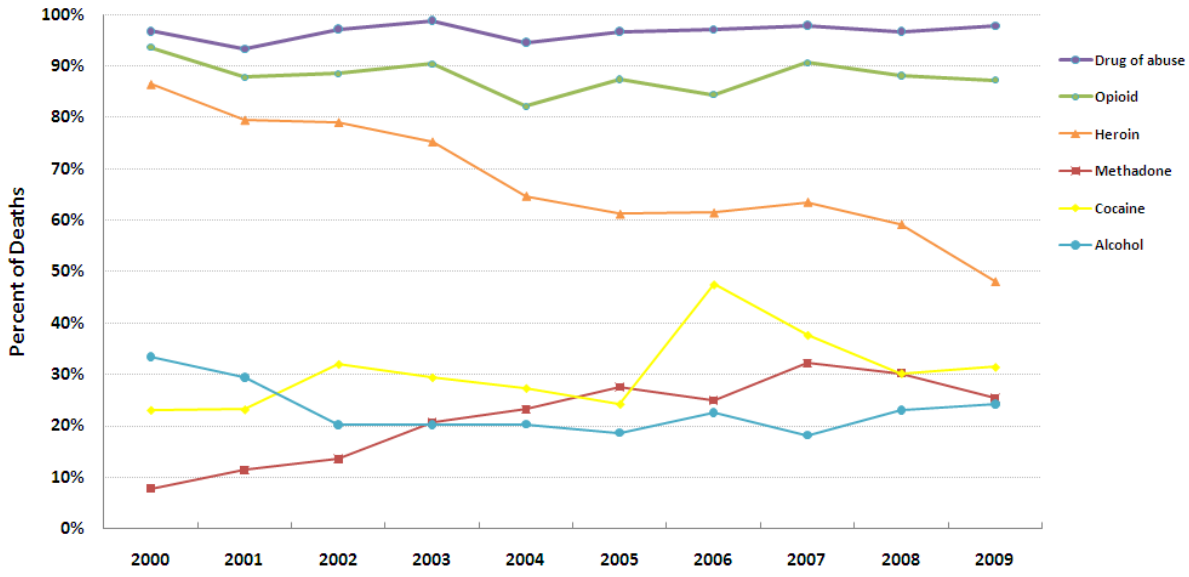


Figure 5 displays the *percentage* of intoxications deaths among city residents associated with specific substances. *Figure 5* shows that the percent of intoxication deaths associated with heroin decreased substantially between 2000 and 2004 (from 86% of deaths to 64%), and again between 2007 and 2009 (from 64% to 48%) In contrast, methadone deaths have increased as a percentage of intoxication deaths regularly since 1999, going from less than 10% in 1999 to 25% in 2009.

Figure 5

Percentage of Drug of Abuse or Alcohol-related Deaths Associated with a Specific Substance, Baltimore City Residents, 2000-2009



❖ *Demographic Characteristics of Victims*

As in 2008 and previous years, victims of fatal drug of abuse- or alcohol-associated intoxications in 2009 were predominantly male, Black, and were on average in their mid-forties (Table 2). As in 2008, there was one death in a minor in 2009.

Table 2: Sex, Race, and Age of Victims of Fatal Intoxications Associated with Drugs of Abuse or Alcohol According to Medical Examiner Records, 2008 and 2009

	Baltimore City resident deaths		Deaths resulting from intoxications in Baltimore City	
	2009	**2008**	**2009**	**2008**
	%	%	%	%
Sex	n=181	n=152	n=229	n=174
% Male	72.3%	67.1%	75.5%	68.4%
Race				
% African American	60.8%	63.8%	53.7%	59.8%
% White	38.7%	36.2%	45.9%	40.2%
Age				
Mean (SD)	44.9 (10.8)	45.3 (11.3)	44.4 (10.6)	45.0 (10.9)
Min-Max	3.7-67.3	1.9-74.2	3.7-67.3	1.9-74.2

❖ *Geographic Distribution of Deaths*

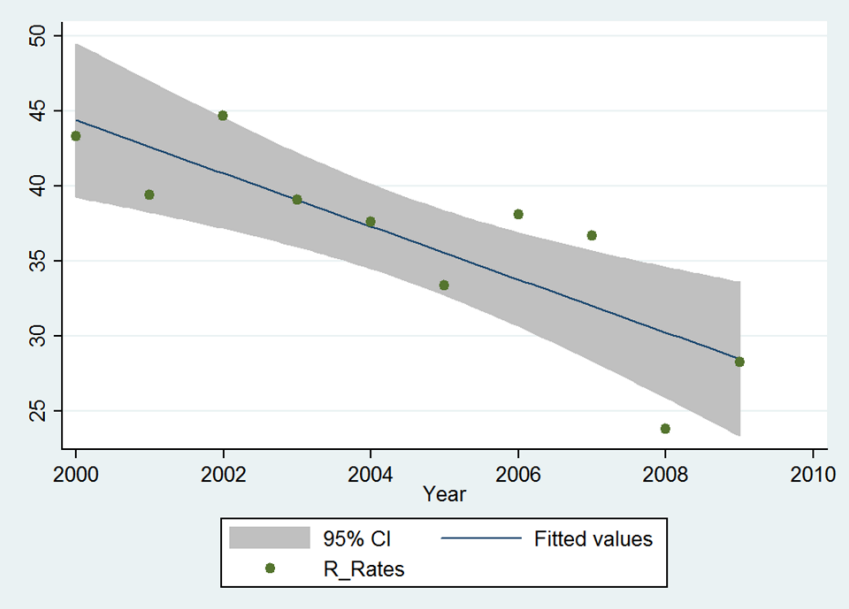
Map 1 (page 8) shows that, in 2009, crude intoxication death rates associated with drugs of abuse or alcohol among Baltimore City residents were highest in zip codes 21201, 21217, and 21223 on the City's west side, zip code 21225 in southern Baltimore, zip code 21234 in northeast Baltimore, zip code 21213 on the City's east side, and zip code 21224 in southeast Baltimore. *Map 2* (page 9) shows intoxication death rates over the most recent 5 years for which complete data are available. These rates should be interpreted with caution, given that they are based on 2000 Census zip code populations and not all zip codes are completely within Baltimore City limits. Additionally, these are crude rates, not age-adjusted rates which are more suitable for comparison. Both *Maps 1* and *2* are based on the zip code of the victims' *residence* (not the zip code of their death). In contrast, *Map 3* shows the distribution of intoxication deaths among Baltimore City residents for the most recent 5 years based on the zip code of the victims' *death* (page 10).

CONCLUSION

Intoxication deaths associated with drugs of abuse or alcohol increased from 2008 to 2009. Increases were most pronounced for alcohol-associated and cocaine-associated deaths, while heroin-associated and methadone-associated deaths remained essentially the same. However, it should be noted that 2008 saw a remarkable drop in intoxication deaths that to date has not been fully understood. Thus comparing 2009 numbers to those from 2008 may mask the actual trend in deaths and death rates (*Figure 6*). Indeed, compared to 2007, there were 23% fewer Baltimore City resident intoxication deaths in 2009, and the death rate was 23% lower. Overall, intoxication deaths among residents during the last decade have declined from 281 in 2000, to 181 in 2009—an average drop of 10 deaths per year.

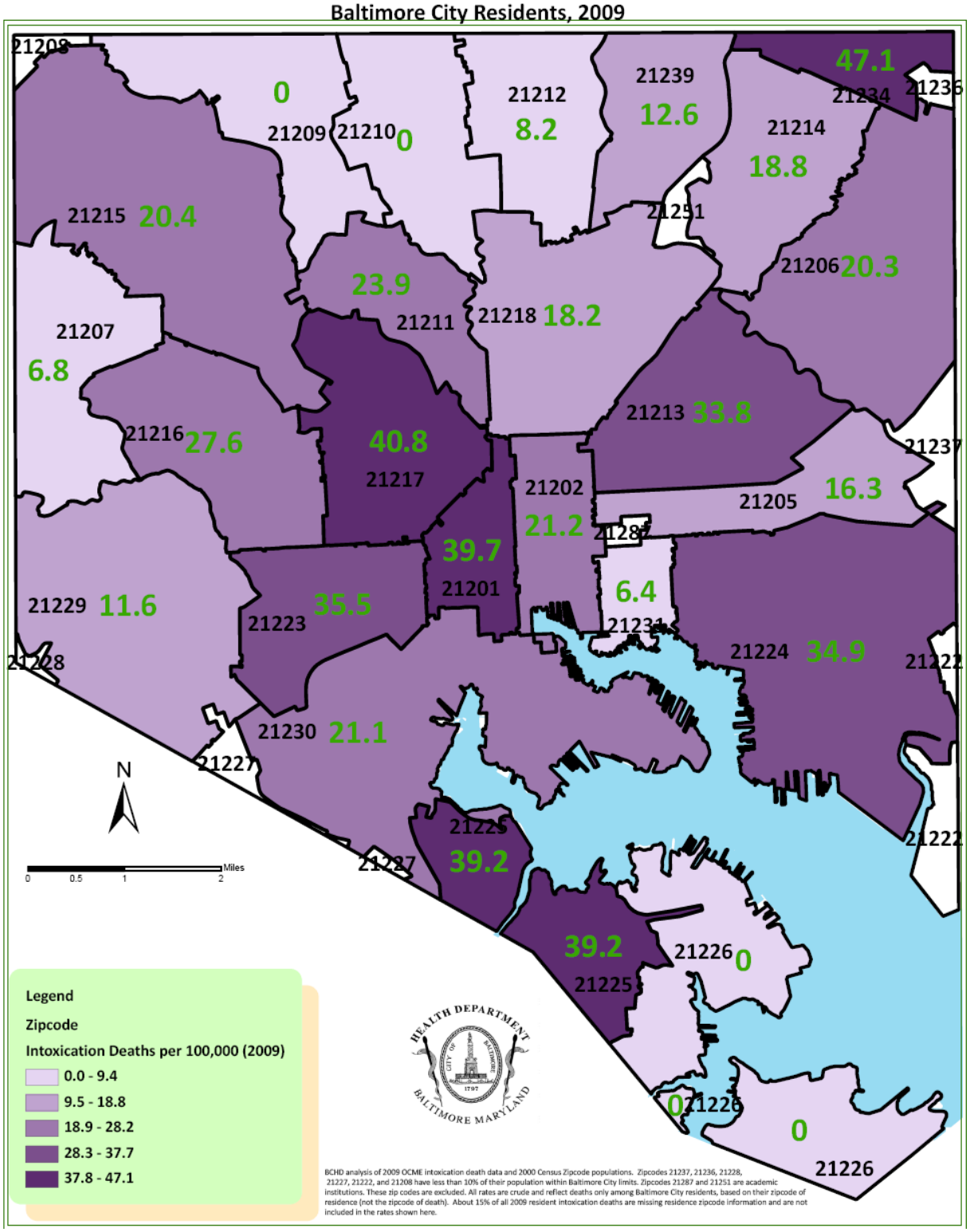
Figure 6

Intoxication Death Rates Associated with Drugs of Abuse or Alcohol: Baltimore City Residents, 2000-2009 Trend Line w/ 95% Confidence Intervals (Deaths per 100,000)



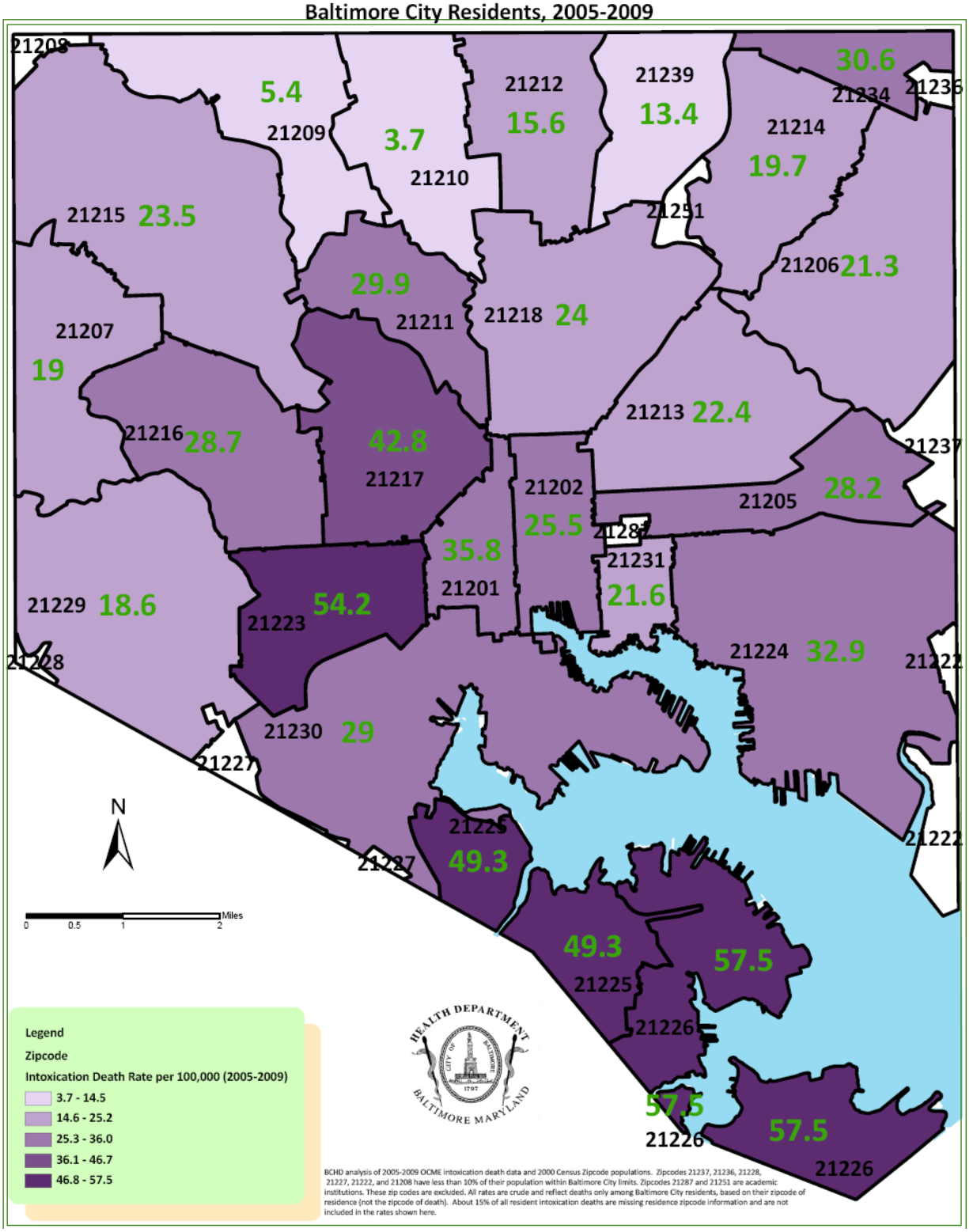
Map 1

Crude Intoxication Death Rates from Drugs of Abuse or Alcohol by Zip Code, Baltimore City Residents, 2009



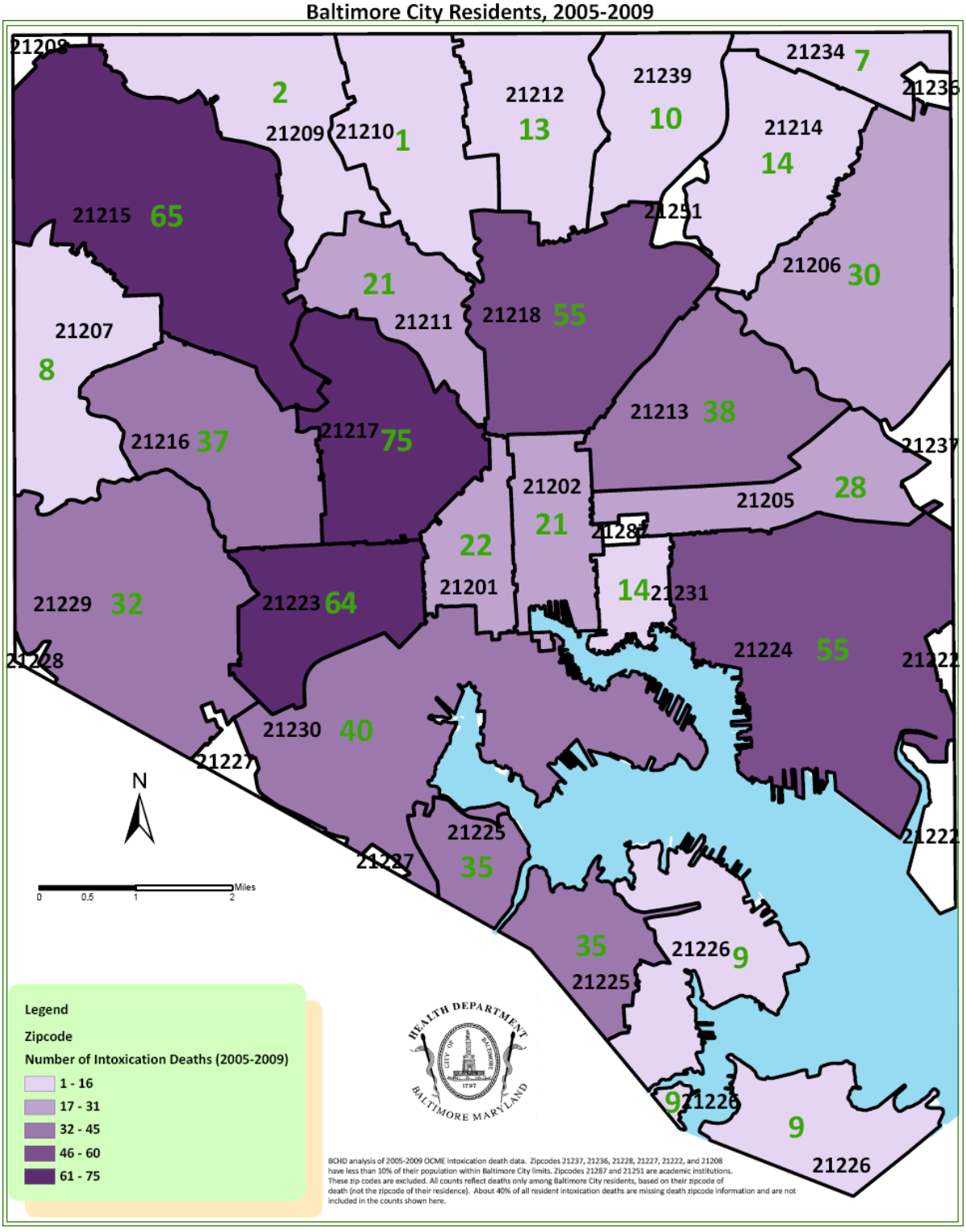
Map 2

Crude Intoxication Death Rates from Drugs of Abuse or Alcohol by Zip Code, Baltimore City Residents, 2005-2009



Map 3

Intoxication Death Counts from Drugs of Abuse or Alcohol by Zip Code of Death, Baltimore City Residents, 2005-2009



APPENDIX 1: DATA TABLES

Table A1: Number of Drug of Abuse- or Alcohol-associated Intoxication Deaths Among Baltimore City Residents

Intoxication death involves[1]	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Alcohol or at least one drug of abuse	281	254	287	251	241	214	244	236	152	181
At least one drug of abuse	272	237	279	248	228	207	237	231	147	177
Opioids	263	223	254	227	198	187	206	214	134	158
Opioids and cocaine	56	46	67	56	38	32	86	73	33	39
Opioids and alcohol	83	57	49	44	32	33	39	36	27	37
Opioids without other drugs of abuse or alcohol	138	130	148	138	133	121	93	114	80	81
Heroin	243	202	227	189	156	131	150	150	90	87
Heroin and cocaine	50	44	63	51	32	24	67	57	27	24
Heroin and alcohol	80	55	48	37	27	26	31	27	19	24
Heroin without other drugs of abuse or alcohol	120	104	111	96	86	67	53	60	38	38
Methadone	22	29	39	52	56	59	61	76	46	46
Methadone and heroin	10	15	18	22	21	16	20	20	9	7
Methadone and cocaine	6	3	6	9	10	6	27	18	4	10
Methadone and alcohol	4	4	1	5	8	4	3	7	7	3
Methadone without other drugs of abuse or alcohol	6	12	18	23	23	28	19	36	26	24
Buprenorphine[2]				0	0	0	0	1	0	0
Fentanyl	1	0	1	3	2	3	10	3	3	4
Codeine, Oxycodone or Hydrocodone	5	5	2	5	2	11	8	9	8	7
Cocaine	65	59	92	74	66	52	116	89	46	57
Cocaine and alcohol	16	13	11	14	8	3	22	11	11	7
Cocaine without other drugs of abuse or alcohol	7	12	24	16	25	20	22	15	10	15
Benzodiazepines	2	3	0	2	1	2	2	5	2	8
Alcohol	94	75	58	51	49	40	55	43	35	44
Alcohol without other drugs of abuse	9	17	8	3	13	7	7	5	5	4

[1] Except where noted, involvement of one substance does not preclude the possibility that other substances are involved as well.
[2] In contrast with the other substances in this table, samples are not routinely tested for buprenorphine, only when it is deemed indicated by the OCME.

Table A2: Number of Deaths Resulting from Intoxications Occurring in Baltimore City Regardless of Residence

Intoxication death involves[1]	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Alcohol or at least one drug of abuse	327	298	343	296	273	249	290	281	176	229
At least one drug of abuse	316	280	334	290	257	239	283	271	171	225
Opioids	305	265	307	268	224	217	248	253	155	201
Opioids and cocaine	60	59	81	69	49	42	102	88	39	47
Opioids and alcohol	99	68	58	52	43	37	52	43	33	45
Opioids without other drugs of abuse or alcohol	159	152	179	161	140	138	110	131	89	108
Heroin	285	245	276	223	179	161	184	185	106	118
Heroin and cocaine	54	58	77	63	42	34	81	71	31	29
Heroin and alcohol	96	66	57	46	36	30	42	34	22	31
Heroin without other drugs of abuse or alcohol	141	125	136	111	94	83	62	72	45	55
Methadone	23	30	43	58	57	61	69	85	51	51
Methadone and heroin	11	16	20	23	23	17	22	25	12	11
Methadone and cocaine	6	3	5	9	13	6	29	21	7	11
Methadone and alcohol	4	4	2	5	8	4	3	8	8	5
Methadone without other drugs of abuse or alcohol	6	11	20	28	21	28	23	38	25	24
Buprenorphine[2]				0	0	0	0	1	0	0
Fentanyl	1	0	1	3	2	3	12	3	2	4
Codeine, Oxycodone or Hydrocodone	5	6	3	6	4	12	12	10	8	10
Cocaine	71	72	107	89	80	64	136	105	55	69
Cocaine and alcohol	17	18	12	17	12	5	27	13	12	9
Cocaine without other drugs of abuse or alcohol	9	12	25	18	28	21	25	16	12	18
Benzodiazepines	4	3	1	1	2	2	2	7	2	10
Alcohol	112	87	68	61	63	48	69	55	42	54
Alcohol without other drugs of abuse	11	18	9	6	16	10	7	10	5	4

[1] Except where noted, involvement of one substance does not preclude the possibility that other substances are involved as well.

[2] In contrast with the other substances in this table, samples are not routinely tested for buprenorphine, only when it is deemed indicated by the OCME.

Table A3: Rates[1] of Drug of Abuse- or Alcohol-associated Intoxication Deaths Among Baltimore City Residents (deaths/100,000)

Intoxication death involves[2]	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Alcohol or at least one drug of abuse	43.3	39.4	44.7	39.1	37.6	33.4	38.1	36.9	23.8	28.4
At least one drug of abuse	41.9	36.7	43.4	38.6	35.6	32.3	37.0	36.1	23.0	27.8
Opioids	40.5	34.6	39.5	35.3	30.9	29.2	32.1	33.4	21.0	24.8
Heroin	37.5	31.3	35.3	29.4	24.3	20.5	23.4	23.4	14.1	13.6
Methadone	3.4	4.5	6.1	8.1	8.7	9.2	9.5	11.9	7.2	7.2
Cocaine	10.0	9.1	14.3	11.5	10.3	8.1	18.1	13.9	7.2	8.9
Alcohol	14.5	11.6	9.0	7.9	7.6	6.2	8.6	6.7	5.5	6.9

[1] Population denominators for rates are from 2009 CDC Wonder (Vintage 2009) population estimates. Rates are not age adjusted, as age information was not available prior to 2003. However, crude rates were nearly identical to age-adjusted rates for 2003-2008.

[2] Involvement of one substance does not preclude the possibility that other substances are involved as well.

Table A4: Percent of Drug of Abuse- or Alcohol-associated Intoxication Deaths Among Baltimore City Residents by Substance

Intoxication death involves[1]	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Alcohol or at least one drug of abuse	100	100	100	100	100	100	100	100	100	100
At least one drug of abuse	97	93	97	99	95	97	97	98	97	98
Opioids	94	88	89	90	82	87	84	91	88	87
Heroin	86	80	79	75	65	61	61	64	59	48
Methadone	8	11	14	21	23	28	25	32	30	25
Cocaine	23	23	32	29	27	24	48	38	30	31
Alcohol	33	30	20	20	20	19	23	18	23	24

[1] Involvement of one substance does not preclude the possibility that other substances are involved as well.

APPENDIX 2: LIST OF DRUGS IDENTIFIED IN MEDICAL EXAMINER RECORDS OF BALTIMORE CITY INTOXICATION DEATHS, JANUARY 1995-DECEMBER 2009

Drugs of Abuse

(* indicates drugs of abuse that are included in the medical examiner's routine toxicological analysis)

Opioids

Buprenorphine
Codeine*
Fentanyl*
Heroin (and metabolite 6-monoacetylmorphine*)
Hydrocodone*
Hydromorphone
Meperidine*
Methadone*
Morphine*
Oxycodone*
Pentazocine*
Propoxyphene*
Tramadol*

Non-opioids

Alprazolam*
Amobarbital*
Amphetamine*
Butalbital*
Chloral hydrate (metabolized to trichloroethanol)
Chlordiazepoxide*
Clonazepam
Cocaine* (and metabolite benzoylecgonine*)
Dextromethorphan*
Diazepam*
Ethanol*
Flurazepam*
Ketamine*
Lorazepam
Methamphetamine*
Methylenedioxyamphetamine (MDA)*
Methylenedioxymethamphetamine (MDMA)*
Meprobamate*
Midazolam
Nordiazepam*
Pentobarbital*
Pentothal
Phencyclidine (PCP)*
Phenobarbital*
Phentermine*
Secobarbital*
Sodium Thiopental/Sodium
Triazolam
Zopiclone
Zolpidem*

Not Drugs of Abuse

Acetaminophen
Amitriptyline
Amoxapine
Atenolol
Atropine
Bupropion
Carbamazepine
Carbon monoxide (CO)
Cardizem
Carisoprodol
Chlorodifluoromethane
Chlorpheniramine
Chlorpromazine
Citalopram
Cyclobenzaprine
Cyproheptadine
Desipramine
Desmethylvenlafaxine
Diltiazem
Diphenhydramine
Doxepin
Doxylamine
Duloxetine
Ethylene Glycol
Fluoxetine
Gasoline
Hydrochlorothiazide
Hydroxyzine
Imipramine
Isopropanol
Isopropyl alcohol
Lamotrigine
Lidocaine
Lithium
Methane
Methanol
Metoclopramide
Metoprolol
Mirtazapine
Nifedipine
Norfluoxetine
Nortriptyline
Olanzapine
Pancuronium Bromide (Pavulon)
Paroxetine
Perphenazine
Pheniramine
Phenytoin
Potassium chloride
Primidone
Procaine
Promethazine
Propanol
Propofol
Propranolol
Pseudoephedrine
Quetiapine
Quinine
Rocuronium Bromide
Salicylic acid
Salicylate
Sertraline
Sodium Penthanol
Theophylline
Thioridazine
Toluene
Topiramate
Trazodone
Tricyclate
Trimethoprim
Tricycline
Venlafaxine
Verapamil